CHAPTER 1

General Introduction
CHAPTER 1

From inter-coalitional aggression in hunter-gather societies to racism in modern times, outgroup prejudice appears to be a constant phenomenon across history and society. Notably, though, outgroups are not homogeneous in the prejudices they generate. In facing different kinds of outgroups, individuals may experience varied emotional and behavioral responses. For example, studies in the U.S. have found that the prejudice toward African Americans is motivated more by fear, whereas the prejudice toward gay men is motivated more by disgust (Cottrell & Neuberg, 2005). Heterogeneity in prejudices might also exist toward immigrants as a function of immigrants’ nation of origin and sex. This type of variability is implied by the threat management framework on outgroup prejudice (Neuberg, Kenrick, & Schaller, 2011; Neuberg, & Schaller, 2016). The threat management framework focuses on differences in prejudice against different outgroups and explains how prejudice could be viewed as functionally organized mechanisms to deal with the different threats that outgroups pose. The present dissertation aims to understand intergroup bias from the evolutionary threat management perspective by uncovering how attitudes toward outgroups who pose violence versus pathogen threats would differently be moderated by (a) sex of outgroups, (b) temporarily activated versus chronically experienced individual differences in pathogen disgust sensitivity, and (c) women’s reproductive hormones.

**Evolutionary Threat Management Perspective**

Life in an ancestral environment was filled with survival challenges, such as scarce food, unpredictable environment and formidable predators. Indeed, living in groups and cooperating with trustworthy partners afforded fundamental advantages to our ancestors, such as, social exchange, mating opportunities and cooperative child-rearing, all of which ultimately increased one’s chances of achieving reproductive fitness (Caporael, 2001; Foley, 1995). However, although more frequent interpersonal interactions provide human groups great benefits, they also expose individuals to potential threats. The evolutionary threat management perspective suggests that violence and pathogen threats are two main interpersonal threats within a cooperative social ecology in our ancestral environment (Neuberg et al., 2011). In order to minimize the costs of dealing
with distinct interpersonal threats, individuals have likely evolved functionally distinct psychological mechanisms (see Table 1.1), which consist of different cognitions, emotions and behavioral inclinations (Neuberg et al., 2011; Neuberg & Schaller, 2016).

Perceptions of violence threats activate a self-protection system. In this system, when cues of potential physical harm from other people are detected, individuals might generate emotional responses such as anger or fear (Cottrell & Neuberg, 2005). They may also develop behavioral responses toward the threatening target, for example, to fight or escape (Cesario, Plaks, Hagiwara, Navarrete, & Higgins, 2010). On the other hand, perceptions of pathogen threat activate a pathogen avoidance system, which generates disgust and behavioral avoidances toward the target (see Tybur, & Lieberman, 2016).

Table 1.1

<table>
<thead>
<tr>
<th>Psychological defense mechanisms against violence and pathogen threats</th>
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<td>Mechanism</td>
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<td>Violence threat</td>
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Not all interpersonal interactions are equally likely to pose violence and pathogen threats. Compared to ingroup members, interactions with outgroup members could induce, more of both, violence and pathogen threats. Regarding violence threat, given the long history of intergroup conflict in ancestral populations, members of coalitional outgroups are especially likely to be viewed as potential threats to physical safety (Neuberg, & DeScioli, 2015). Fossil evidence of human warfare indicates that as much as 20-30% of ancestral men died from intergroup violence (Keely, 1996). Although warfare is less in modern society, various types of intergroup violence (e.g., terrorist attack, gang fighting) remain a serious problem. Thus, intergroup contexts are often spontaneously perceived as competitive and hostile (Johnson et al., 2006; Wildschut, Pinter, Vevea, Insko, & Schopler, 2003). Consistent with this idea, research has shown
that, when facing members of outgroups that culturally stereotyped as violent, people who have higher self-protective motives are more likely to perceive neutral expressions as angry expressions in outgroup faces (Maner et al., 2005), as well as display avoidance behavior more quickly (Miller, Zielaskowski, Maner, & Plant, 2012).

Interactions with outgroup members might also connote a higher pathogen threat compare to interactions with ingroups for two different reasons (Fincher, & Thornhill, 2012; Tybur et al., 2016). First, due to host-parasite coevolution, individuals might have acquired less immunity to the novel pathogens that are hosted by outgroup members. Second, because of the lack of specific cultural knowledge, outgroups are more likely to violate local hygiene norms or customs, which serve to neutralize local parasites. Previous research has also tested the association between pathogen avoidance motives and intergroup bias. For example, a few studies have reported that, when contagious diseases are made salient, people report greater ethnocentrism (Navarrete & Fessler, 2006) and greater prejudice against immigrants (Faulkner, Schaller, Park, & Duncan, 2004; Huang, Sedlovskaya, Ackerman, & Bargh, 2011).

**Gendered Outgroup Prejudice**

Importantly, outgroup prejudice could be sex-specific. Due to differences in parental investment, men and women have developed distinct reproductive strategies (Trivers, 1972). Parental investment differences may have a significant influence on the underlying psychological mechanisms that govern men and women’s approach to intergroup conflict (Goldstein, 2003). For example, men might benefit more than women from engaging in risky intergroup aggression because it increases their access to mating opportunities (Tooby, & Cosmides, 1988). In contrast, women have more to lose (e.g., reproductive choices) and less to gain in intergroup violence. Women have long been the victims of sexual aggression in intergroup conflicts across history (Thornhill, & Palmer, 2000). Furthermore, previous studies indicate that men are the main initiators and targets of outgroup prejudice in intergroup conflicts (Navarrete, Fessler, Fleischman, & Geyer, 2009); this has been referred to as the male warrior hypothesis (McDonald,
Navarrete, & Van Vugt, 2012; Vugt et al., 2007).

Sex and Violence – Male Warrior Hypothesis

It is clear that, the reproductive payoffs for engaging in risky and aggressive intergroup conflicts are greater for men than women (Buss, & Shackelford, 1997; Navarrete, McDonald, Molina, & Sidanius, 2010). The male warrior hypothesis suggests that to solve a wide range of adaptive problems including protecting and getting access to reproductive resources, men may possess psychological mechanisms that enable them to form coalitions that are capable of planning, initiating and executing acts of aggression toward outgroups (McDonald et al., 2012; Vugt, Cremer, & Janssen, 2007). In line with this argument, research has shown that men are more likely to engage in intergroup aggression, both in the real-world and in experimental lab conditions (McDonald, et al., 2012; Van Vugt et al., 2007). Moreover, research on both traditional societies and modern street gangs has shown that male warriors have more mating opportunities than the other men in the group (Chagnon, 1988; Palmer & Tilley, 1995). Therefore, in facing such male coalitional threats, individuals might perceive outgroup men as posing greater violence threats and therefore, show more bias against outgroup men than outgroup women.

Sex and Pathogen Avoidance

Outgroup men might not be perceived as more threatening than outgroup women in all circumstances. Though relevant literature has found that, due to the influence of sex hormones and sex chromosome genes, there are some pathogens that men are less susceptible to than women are (Bernin, & Lotter, 2014; Klein, & Flanagan, 2016), these sex differences are smaller than those in violent aggression. To our knowledge, no research has compared attitudes towards male and female outgroups who pose a potential pathogen threat. The present dissertation suggests that attitudes would be similar toward outgroup men and women who are perceived as posing potential pathogen threat.
CHAPTER 1

Individual Differences

The mechanism that integrates the threat management system and intergroup bias may not only generate different responses to outgroup men and women, but these responses may also be moderated by both between- and within-individual differences of the ingroup members. For example, between individuals, women who perceived themselves as highly vulnerable to sexual coercion showed greater biases against outgroup men compared to those who perceived themselves as being less vulnerable (Navarrete et al., 2009; Navarrete et al., 2010). Meanwhile, within individuals, women’s vulnerability to sexual coercion may change across the menstrual cycle. Research has shown that women report greater bias against outgroup men during the high fertile phase of their menstrual cycle compared to low fertile phases (Navarrete et al., 2009). In the present dissertation, I will discuss the effects of within-individual differences of women’s menstrual cycle shift and between-individual differences of pathogen avoidance motives on intergroup bias.

Reproductive Hormones and Threats Sensitivity

Over the last two decades, more studies and greater attention has been focused on whether women’s mating related preferences, cognitions, and behaviors systematically change across menstrual cycle (see Gildersleeve, Haselton, & Fales, 2014; Wood, Kressel, Joshi, & Louie, 2014). Early research on cycle effects were criticized because of small sample sizes, between-subjects designs and counting methods to locate the position of women’s cycle to estimate conception risk (Gangestad et al., 2016). Empirical and data-simulated studies have shown that counting methods, both forward and backward counting, are generally inaccurate and require a very large sample size to reach a desirable statistic power (Blake, Dixson, O'Dean, & Denson, 2016). Indeed, Gangestad and colleagues recommend assessment of reproductive hormones (i.e., estradiol and progesterone) to test the cycle effect. The ratio of estradiol to progesterone (i.e., E/P ratio) has been suggested to be a relatively reliable index of fertility and the luteal phase (See Figure 1.1, extracted from Roney, 2018). Specifically, the E/P ratio rises in the late follicular phase and reaches its peak before ovulation. It then
exhibits a very sharp decline from a mid-cycle peak, which approximately coincides with the day of ovulation, and reaches its lowest level in the luteal phase (Baird, Weinberg, Wilcox, McConnaughey, & Musey, 1991; Roney, 2018). Research suggests that E/P ratio predicts fertility better than either hormone does in isolation (Baird et al., 1991), while other work suggests that it predicts within-participant changes in mating-relevant behaviors better than either hormone does in isolation (Eisenbruch, Simmons, & Roney, 2015; Wang, Hahn, Fisher, DeBruine, & Jones, 2014). Therefore, in the present dissertation, I will discuss the effect of E/P ratio as indicator of fertility and cycle change.

Given the importance of reproductive choices on women’s sexual strategy, research suggests that women’s threat sensitivity may vary across the menstrual cycle. Specifically, during the fertile phase of the cycle, when sexual coercion carries the highest reproductive costs (e.g., unwanted pregnancy), women may be more sensitive to threat of sexual coercion and show greater biases against physically threatening men (Bröder & Hohmann, 2003; Chavanne & Gallup, 1998; Garver-Apgar, Gangestad, & Simpson, 2007). Consistent with this hypothesis, research has shown that when conception risk is high, women perceive unacquainted men as more coercive (Garver-Apgar, Gangestad, & Simpson, 2007), and therefore, show less risk-taking behaviors, which might help to avoid coercive men (Bröder & Hohmann, 2003; Chavanne & Gallup, 1998). Women also perceive themselves as physically stronger, which might help to defend against potential threat of sexual coercion (Prokop, 2013).

Aside from the association between fertility and sexual coercion avoidance, there is also a possible association between the luteal phase and greater avoidance of pathogens, including those transmitted by conspecifics (Fessler & Navarrete, 2003; Fleischman & Fessler, 2011; cf. Jones et al., 2018b). According to the compensatory behavioral prophylaxis hypothesis, during the luteal phase in women’s menstrual cycle, which is characterized by a high progesterone level, women experience suppressed immune system functioning in order to prevent their bodies from rejecting a potential fetus. This immunosuppression increases women’s vulnerability to forms of pathogens. As a result, women should show greater behavioral avoidance toward potential infections (Fessler, 2001; Fessler & Navarrete, 2003; Fleischman & Fessler, 2011).

The evidence presented suggests that there is an association between fertility
and sexual coercion avoidance, as well as an association between the luteal phase and pathogen avoidance. Thus, the present dissertation will test how biases against men who pose either potential violence or pathogen threat changes across the menstrual cycle, as women’s reproductive hormones fluctuate.

Figure 1.1. Mean estradiol to progesterone ratio changes across menstrual cycle (day 0 represents the day of ovulation). Negative days indicates days before ovulation and positive days indicate days after ovulation. Figure was extracted from Roney (2018).

Pathogen Avoidance Motives and Outgroup Prejudice

Some of the most striking studies have shown an association between pathogen avoidance motives and outgroup prejudice. At the individual differences level, individuals who report more disgust and anxiety toward pathogen cues (e.g., coughing people, bodily wastes) exhibit greater negativity toward outgroups (Aarøe, Petersen, & Arceneaux, 2017; Navarrete, & Fessler, 2006). At the contextual level, cues to pathogens, such as disgust-eliciting pictures, trigger behavioral immune system responses (Tybur, & Lieberman, 2016), which may also trigger, outgroup prejudice. Some studies have found that temporary exposure to pathogen cues (e.g., viewing images of a dirty toilet or reading news
of swine flu) increases prejudice towards an arbitrary outgroup created by a minimal-groups procedure (Buckels, & Trapnell, 2013) as well as towards real-world immigrants (Faulkner et al., 2004; Huang, Sedlovskaya, Ackerman, & Bargh, 2011). In the present dissertation, I will investigate how contextual and individual differences in pathogen avoidance motivations might influence outgroup prejudice, and further investigate the target of pathogen-based outgroup prejudice.

The Present Dissertation

Understanding how people’s attitudes toward outgroups is influenced by threat perception is a relatively new approach with a lot to uncover. The present dissertation contributes to the extant literature of the evolutionary threat management framework on intergroup biases. Specifically, it focuses on violence and pathogen threats and investigates (a) whether people view male and female immigrants similarly or differently depending on what types of threats they are perceived to pose, (b) how contextual and individual differences of pathogen avoidance motives might influence pathogen-based outgroup prejudice, and (c) how the fluctuation of women’s reproductive hormones might influence such threat-related intergroup biases. In order to investigate these effects, I utilized various types of manipulations for threat perception (e.g., via threat priming, facial cues, vocal cues), applied different techniques (e.g., survey, hormone measures), and attitudes measures (e.g., self-report attitude, implicit attitudes) and even defined outgroups in a number of ways (e.g., ethnicity, minimal-group context). We hope that the variety of the methodological choices can help us better understand the strength of the threat-outgroup-prejudice association, and the potential mechanisms behind this association (see Figure 1.2 for the summary of the empirical chapters).
Summary of Empirical Chapters

Chapter 2: Evolutionary Threat Management on Gendered Anti-Immigrant Biases

Are male and female immigrants viewed similarly or differently? Chapter 2 sought to answer this question following an evolutionary threat management perspective. As I previously described, how similarly people view male and female immigrants might depend on what type of threat immigrant groups are perceived to pose. I hypothesized that people would have more negative attitudes toward male than female immigrants who come from a violent ecology, but that attitudes would be similar toward male and female immigrants from a pathogen-rich ecology. To test the hypotheses, the first two studies compared attitudes toward male versus female immigrants from a specific violent ecology (i.e., Syria, Studies 2.1 and 2.2), a pathogen-rich ecology (i.e., Liberia, Studies 2.1 and 2.2), and a low-threat ecology (i.e., Lithuania, Study 2.2). Next, I replicated Study 2.1 by removing the name of the countries, comparing attitudes toward male and female immigrants from non-labeled violent and pathogen-rich ecologies (Study 2.3). Finally, an internal meta-analysis of three studies was conducted, and in line with the hypotheses, the findings showed that attitudes toward male immigrants from a violent ecology were more negative than attitudes toward female immigrants from the same ecology. In contrast, attitudes toward male and female immigrants were similar when those immigrants came from a pathogen-rich ecology. Further, differences in attitudes toward male and female Syrian immigrants were mediated by perceived violence threat toward these immigrants. The findings are consistent with the evolutionary threat management perspective on outgroup prejudice and are aligned with the male warrior hypothesis: Attitudes toward male versus female outgroup members vary in accordance with the potential threats these outgroups pose.

Chapter 3: The role of temporary and chronic pathogen avoidance motivation in Anti-Immigrant Biases

Chapter 2 compared attitudes toward immigrants who were perceived as posing either violence or pathogen threat. Chapter 3 focused on pathogen-based
outgroup prejudice, and tested the association between pathogen avoidance motives and attitudes toward immigrants at both the experimental and individual differences level. Across four studies (total N = 1849), I manipulated exposure to pathogen cues to test whether temporarily activated pathogen avoidance motives and individual differences in pathogen disgust sensitivity (PDS) would increase prejudice toward (a) an origin-unspecified immigrant group (Study 3.1, 3.2, 3.3 and 3.4) and (b) origin-specific immigrants that come from a pathogen-rich ecology (Studies 3.3 and 3.4). Internal meta-analyses were conducted after observing inconsistent effects of pathogen priming and PDS across four studies. Results of the meta-analyses lent some support to both hypotheses, but favored more of an origin-specific hypothesis. At the experimental level, pathogen primes had no effect on attitudes towards origin-unspecified immigrants or immigrants from a pathogen-rich ecology. At the individual differences level, PDS had a unique negative effect on how comfortable people felt with immigrants from pathogen-rich ecologies, but not on comfort levels with immigrants from unspecified ecologies. However, pathogen disgust sensitivity was negatively related to the decision to allow entry to both origin-unspecified immigrants and immigrants from a pathogen rich ecology.

Chapter 4: Hormonal Influence on Women’s Implicit Intergroup Bias

Chapters 2 and 3 investigated how violence and pathogen threats might influence attitudes toward a specific outgroup – immigrants. Meanwhile, Chapters 4 and 5 focused on the role of women’s reproductive hormones changes across the menstrual cycle on intergroup biases. Previous research has shown that women’s attitudes toward outgroup men vary across the menstrual cycle, presumably to guard against the costs of sexual coercion, costs, which vary according to women’s conception risk. Meanwhile, because outgroup men might pose greater pathogen threat than ingroup men, and women are most vulnerable to pathogen transmission at the peak of progesterone secretion, pathogen threat posed by outgroup men might also vary across the menstrual cycle. Chapter 4 aimed to replicate findings reporting an effect of conception risk on implicit outgroup bias by testing how changes in reproductive hormones covary with changes in implicit biases against outgroup men across the menstrual cycle. Further, we compared biases in response to men posing violence threat versus men posing pathogen
threat. A group of 41 women completed four single-category implicit attitude tasks (one for each threat/group combination) and provided saliva samples once a week for a period of four weeks. Multilevel modeling showed that changes in estradiol-to-progesterone ratio differentially predicted implicit attitudes toward angry faces and infectious faces. However, simple effects tests showed that estradiol-to-progesterone ratio changes did not predict bias against angry faces nor infectious faces, though the bias against angry faces was greater than the bias against infectious faces at high levels of estradiol-to-progesterone ratio. In addition, these biases were the same against ingroup and outgroup men. Our findings suggest that women’s biases against violence and pathogen threats do not vary as a function of hormonal states, and they do not replicate past findings reporting a relationship between hormonal status and intergroup biases.

Chapter 5: Hormonal Influence on Women’s Intergroup Vocal Masculinity Preference

Chapter 4 examined the effect of women’s reproductive hormones on implicit biases against threatening ingroup versus outgroup men. In Chapter 5, I investigated how women’s masculinity preference for ingroup versus outgroup men changes across the menstrual cycle. For women, ideal mates would provide both resources (i.e., direct benefits) and genetic benefits (i.e., indirect benefits). At times, these benefits sometimes might be traded off against each other, since the best fathers do not always offer the best genetic benefits. Here I hypothesized that women solve this adaptive challenge by preferring masculine ingroup men, who might provide the best combination of direct and indirect benefits. Chapter 5 conducted three studies to test the hypothesis. In Study 5.1, I compared women’s masculinity preference for ingroup and outgroup male voices separately, and examined the hormonal effects on such preference. Results found that women have greater masculine preference for ingroup men than outgroup men. However, this preference was not influenced by the changes of women’s reproductive hormones during their menstrual cycle. Next, Study 5.2 and 5.3 directly compared attractiveness ratings of masculinized and feminized male voices from both ingroup and outgroup men, and tested the potential mechanisms behind the preferences. Specifically, Study 5.2 examined the potential moderation effects of mating contexts (long- vs. short-term mating) and social status (low vs. high
status) of men on women’s intergroup masculinity preference. While Study 5.3 tested the potential moderation effects of sociosexual orientation and fear of rape of women, as well as examined the potential mediating effects of aggressiveness and good-father perceptions of men on women’s intergroup masculinity preference. Consistent with Study 5.1, results of Studies 5.2 and 5.3 found that women consistently showed a preference for masculine ingroup men. Moreover, this preference was not moderated by mating context (Study 5.2), social status of men (Study 5.2), sociosexual orientation or fear of rape of women (Study 5.3). Importantly, we found that women’s masculinity preference for ingroup and outgroup men was mediated by how good of a father these men were perceived to be (Study 5.3), which supported the good-father hypothesis on women’s mate-preference in intergroup contexts.
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<tr>
<th>Research Question</th>
<th>Main Findings</th>
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<tr>
<td>Do we treat outgroup men and women differently?</td>
<td>Men from violent ecologies received greater prejudice than women</td>
<td>Pathogen primes had no effect on attitudes toward origin-unspecified immigrants or immigrants from pathogen-rich ecologies</td>
<td>Higher level of E/P ratio related to greater bias against angry than infectious male faces</td>
<td>Women showed a preference for masculine ingroup men over feminine ingroup men and masculine and feminine outgroup men</td>
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<tr>
<td>Do pathogen avoidance motives induce prejudice toward all outgroups indiscriminately?</td>
<td>Men and women from pathogen-rich ecologies received equal prejudice</td>
<td>Pathogen disgust sensitivity positively predicted prejudice toward outgroups from pathogen-rich ecologies, but not unspecified ecologies</td>
<td>However, E/P ratio did not predict biases against angry nor infectious faces respectively</td>
<td>Women's intergroup masculinity preference was not influenced by reproductive hormones</td>
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<td>Do women's biases against threatening ingroup vs. outgroup men change across menstrual cycle?</td>
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<td>Do women's vocal masculinity preferences for ingroup vs. outgroup men change across menstrual cycle?</td>
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**Figure 1.2.** Summary of the empirical chapters.